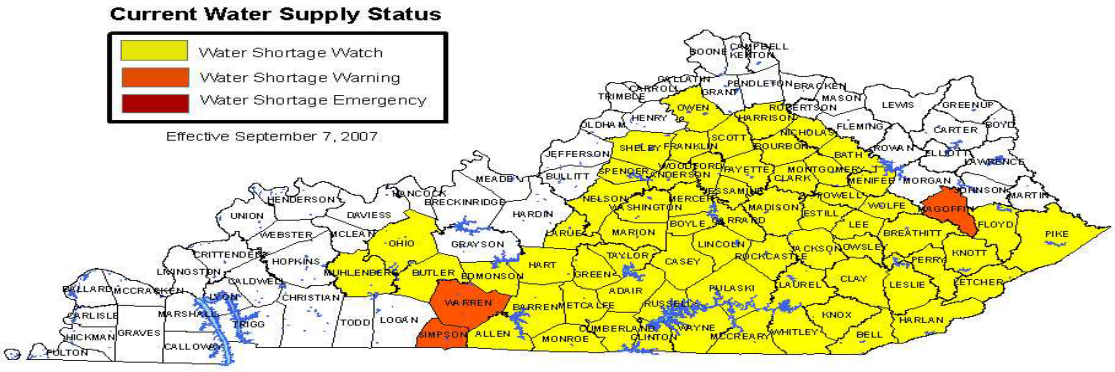
Drought

The Kentucky Division of Water continuously monitors hydrologic conditions throughout the state, including precipitation, streamflows, lake elevations and various drought indices. This information is used to detect emerging drought conditions, to identify the locations and severity of drought and to provide timely and appropriate public notification.

Kentucky Drought Monitoring Center



UPDATE Sept. 24, 2007 – U.S. Army Corps of Engineers projects to allow limited use for

emergency water for livestock watering and fire protection. (To view press release please click here.)

Water Shortage Notification System Explained

Water Shortage Response Status of known public water systems reported to the Division of Water.

Statewide Summary of Drought Development

New Updated Sept. 26, 2007 New

The most recent drought indices (Palmer Drought Severity Index and Drought Monitor) indicate a deepening of drought conditions across most of Kentucky. Extreme drought is now firmly established in the western, bluegrass and eastern climatic divisions. The central climatic division remains in severe drought status, reflecting slightly better rainfall coverage in the region from storm systems that have moved across Kentucky in the past few weeks.

The outlook for at least the next 14 days does not indicate more than slight chances for significant rainfall. This does not preclude the occurrence of localized storms that can provide relief in some places. Beneficial rains in southeastern and southwestern Kentucky have been quite rare this summer. Many small water systems in the headwaters of the Kentucky, Licking and Cumberland rivers are exhibiting signs of diminished water supplies. Rainfall in this region will mitigate these developing problems while providing additional flow to the Kentucky River mainstem, which is the source of drinking water for approximately 700,000 Kentucky citizens.

Hurricanes and tropical storms moving onerland from the Gulf of Mexico are also still a possibility. Moisture-laden tropical depressions that move across Kentucky are capable of producing slow-moving and drenching storms that can alleviate significant drought deficits of soil moisture, groundwater levels and flows in rivers and streams. However, hopes for drenching storm systems from remnants of tropical storms should not be a part of our strategy to manage water supplies diminished by drought.

There are currently 32 water systems in Kentucky that have in place some level of water shortage response. Many of these are proactive in nature and are intended to reduce demand for water before a water shortage situation develops. Others are in direct response to immediate concerns with low streamflows or declining levels of water supply reservoirs. Communities of greatest concern are located in the headwaters of the Kentucky, Licking and Cumberland rivers that rely on small streams or abandoned underground mine works or wells. Other water supplies that rely on small lakes and reservoirs are seeing significant drawdown of their storage, but as a general rule no immediate concerns for water shortages have been reported by this sector of water supplies.

October is historically the driest month of the year in Kentucky. However, a return to more seasonal temperatures can be of some benefit by reducing the demand for water from our rivers, lakes and groundwater. Beneficial rains may make their way into Kentucky over the next two days, further easing some of the discomfort of hot, dry weather. Please remember that it is important for all Kentuckians to comply as fully as possible with any requests made by their water suppliers to help conserve water.

Useful Drought Indicators

PRECIPITATION

For the seven day period ending Sept. 25, 2007, no precipitation was reported in the state. Precipitation for the past 30 days in the Eastern, Central and Western climatic divisions averaged 56 percent of normal (50, 54 and 65 percent of normal respectively) while the Bluegrass climatic division received an average of only 30 percent of normal.

STREAMFLOWS

With the general lack of precipitation and high temperatures, streamflows across the state continue to decline. Approximately half of the real-time stream gaging network is currently below a normal range for this time of year (less than a 25 percentile flow). Nearly one quarter of the gages are now classified as much below-normal (less than a 10 percentile flow).

LAKE ELEVATIONS

Several small water-supply lakes are now approaching abnormally low levels and they will continue to decline with the precipitation deficit. Customer demand has forced a number of these water systems to call for conservation measures. Most lakes under the control of the Huntington District, Louisville District and Nashville

District of the U.S. Army Corps of Engineers are currently operating below their normal lake elevation curves. However, the majority of these deficits are relatively small and it continues to get closer to time for winter pool draw-down. The first week of September, the U.S. Army Corps of Engineers began an early lowering of Rough River Lake to allow for repairs. Releases from Corps of Engineers reservoirs are important to the status of many Kentucky rivers as sources of supply for drinking water, assimilation of wastewater discharges, water quality and aquatic habitat. These rivers include the Green, Barren, Rough, Nolin, Kentucky, Salt, Licking and Big Sandy rivers.

DROUGHT INDICES

Assessing the severity of a drought is made easier with the use of drought indices that combine various source information into a single representative value of drought severity. The Palmer Drought Severity Index uses data for precipitation, temperature and evapotranspiration (the water returned to the atmosphere through the combined actions of evaporation and plant growth) to calculate a number that can be compared across different times and locations. This index was developed in the 1960's in Kansas and Nebraska but has since become a part of drought monitoring in a majority of the United States. The Palmer Drought Severity Index is updated weekly on Monday afternoons.

The Drought Monitor represents a comprehensive assessment of several factors that contribute to the development of drought or that indicate the severity and potential persistence of drought. The Drought Monitor is updated weekly on Thursday mornings.

The Palmer Drought Severity Index and the Drought Monitor indicate severe to extreme drought across Kentucky with the Drought Monitor having the southeastern corner of the state to exceptional.

The Palmer Drought Severity Index issued on Sept. 24, 2007, places the Eastern, Western and Bluegrass climatic divisions in extreme drought status (-4.68, -4.17 and -4.26 respectively). The Central climatic division (-3.50) remains in Severe Palmer Drought.

It is important to note that the Palmer Drought Severity Index is used as a general index of drought over large geographic areas defined by the four climatic divisions of Kentucky. Rainfall that affects one part of a climatic division may substantially improve drought conditions on a county or multi-county level but have little or no impact on the regional average conditions defined by the Palmer Index.

While the Drought Monitor continues to place a majority of the state in extreme agricultural and hydrologic drought status, the area designated as severe drought is expanding and the area in the southeast designated as exceptional drought has decreased to include all or part of 10 counties. The area of exceptional drought includes McCreary, Whitley, Bell, Knox, Harlan, Letcher, Perry, Leslie, Clay and Laurel counties. The areas delineated as severe are delineated as east of a line running south from Greenup County to Pike County and an area in the central portion of the state that runs from Hancock County to Jefferson County on it's northern side and Christian County to Madison County in the south.

As a drought indicator, the Drought Monitor is not limited to four large climatic divisions, rather it incorporates the Palmer Index as just one of several indicators of drought development in a given area. These other indicators include more short-term components including the Crop Moisture Index, Standardized Precipitation Index and weekly streamflow percentiles. The Palmer Drought Severity Index and the Drought Monitor should be considered in combination with more localized data such as rainfall, streamflows, groundwater levels and climatic outlooks to form an accurate assessment of drought severity in a given location.

Drought Monitoring

Drought is a natural and recurring feature of our climate that can be considered a "severe" weather event much like a tornado, a flood or a hurricane. However, there are a few key differences that distinguish drought from other weather events that make it difficult to detect, track and respond to drought.

Part of the difficulty in detecting drought is in the lack of an obvious onset of drought conditions. A drought develops slowly and can appear to mimic a normal spell of dry weather in the summer, a time of the year when dry weather is accepted and expected. Short-term rainfall shortages create problems for agricultural crops, livestock, urban landscapes and other activities that depend on stored soil moisture between rainfall events. We are accustomed to dealing with short-term dry spells in part because there is an expectation that rainfall is just around the corner. However, when rainfall shortages persist for weeks or months at a time, activities that depend on long-term storage of water will be adversely impacted as well. Droughts in Kentucky can have serious negative consequences for drinking water supplies, energy production, commercial and industrial operations, recreation and aquatic habitat.

The negative impacts of drought cannot be avoided but there are ways to reduce them to a manageable level. All water suppliers in the commonwealth should have a water shortage response plan to guide both the supplier and customer during a drought event. It is important for customers to listen to their water suppliers and be ready to take necessary actions to prevent a water shortage problem from developing. This is critical to a successful outcome because the only way to effectively manage the source of water supply is to first manage the demand for water.

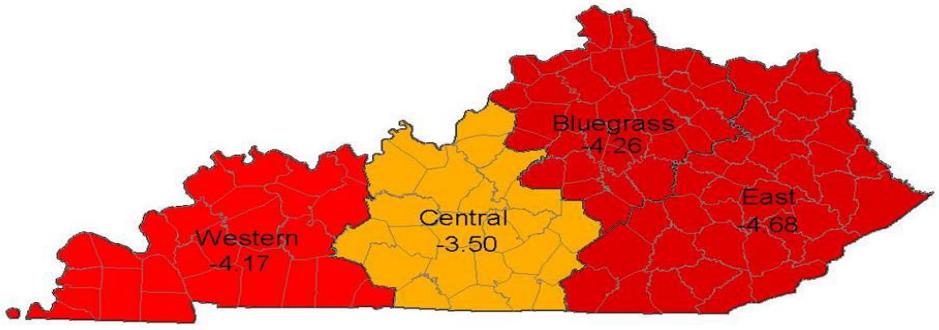
There is no easy method for determining when a dry spell has become a drought, how long a drought will persist or how intense a drought may become. However, by closely tracking certain sources of information, referred to as drought indicators, it is possible to detect potential drought development early enough to allow at least some lead-time for notification and initiation of drought response preparations at the local level. The Division of Water monitors for the potential development of drought in Kentucky by tracking precipitation, streamflows, lake levels, groundwater and water supplies. There are also several tools that are useful in assessing the severity of a "dry spell" and the potential impacts to agriculture, forest fires, water supplies and other vulnerabilities to drought. These tools include the Palmer Drought Severity Index, the Drought Monitor, the Standardized Precipitation Index and several others.

The Drought Monitoring pages will be updated on a weekly basis to provide timely information and assessments of current drought conditions in Kentucky. There will also be numerous links to other resources and drought information pages from various state and federal agencies.

New Updated Sept. 26, 2007 New

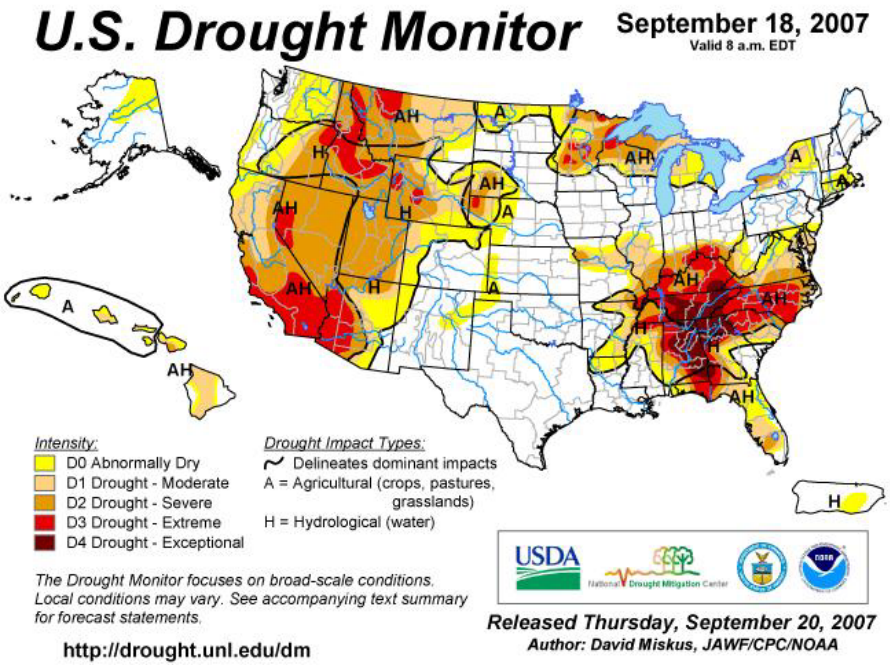
Palmer Drought Severity Index The Palmer Drought Severity Index (PDSI) is compiled weekly by the Central Region Climate Prediction Center (National Centers for Environmental Prediction, National Weather Service and National Oceanic and Atmosphere Administration) and provided on the University of Kentucky Agricultural Weather Center's Web site. This index is useful for placing a developing drought into context with past droughts and serves as a measure of current conditions. The index also provides a standardized assessment of developing drought conditions that can be compared between different areas of the state or even between different states.

PDSI values can be categorized as follows:



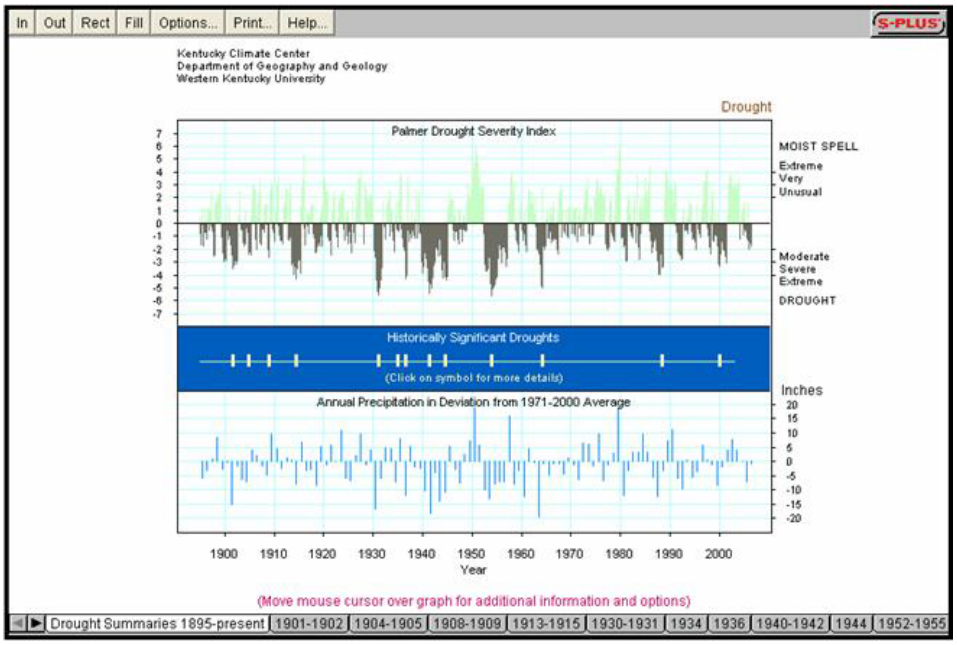
- 0 to -0.99 = near normal
- -1.00 to -1.99 = mild drought
- -2.00 to -2.99 = moderate drought
- -3.00 to -3.99 = severe drought
- -4.00 and below = extreme drought

The Drought Monitor



Tracking drought blends science and art. No single definition of drought works for all circumstances, so people rely on drought indices to detect and measure droughts. But no single index works under all circumstances, either. The Drought Monitor is a synthesis of multiple indices, outlooks and news accounts, that represents a consensus of federal and academic scientists. A detailed description of the parameters used to create the Drought Monitor can be found here.

Kentucky Climate Center Historical Drought Data



Interactive graphs displaying drought indices since 1895 for Kentucky's four climate divisions. Users can identify and explore the development of historically significant droughts.

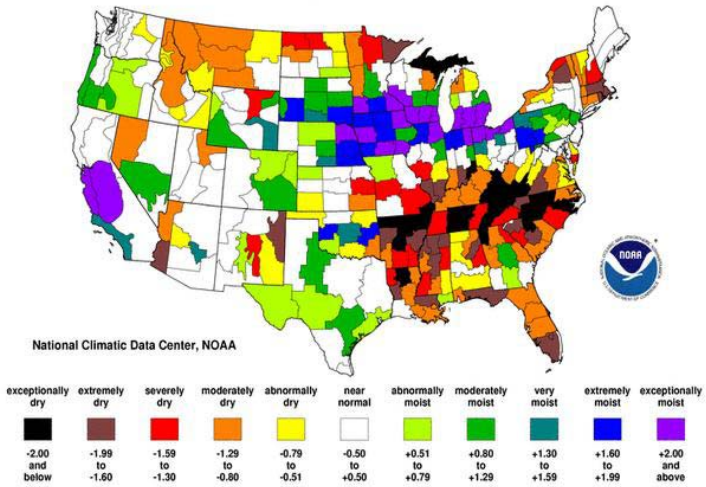
Examining the past can be a useful tool in interpreting the significance of a developing drought situation. Comparisons of the current drought to the historical record provide a frame of reference for evaluating how serious the current drought has become, and how it might develop in the coming months. One of the best tools to evaluate past droughts is found at the Kentucky Climate Center at Western Kentucky University. Click on the figure at the left to visit this site and learn more about the history of drought in Kentucky.

The Standardized Precipitation Index

The Standardized Precipitation Index (SPI) is a way of measuring drought that is different from the PDSI. Like the PDSI, this index is negative for drought and positive for wet conditions. But the SPI is a probability index that considers only precipitation, while Palmer's indices are water balance indices that consider water supply (precipitation), demand (evapotranspiration) and loss (runoff).

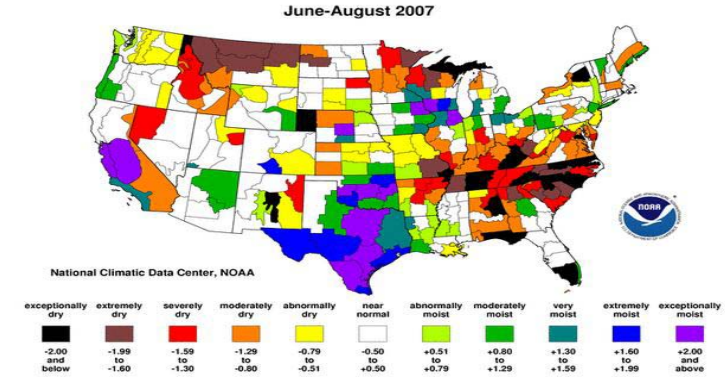
Standardized Precipitation Index
One Month

August 2007



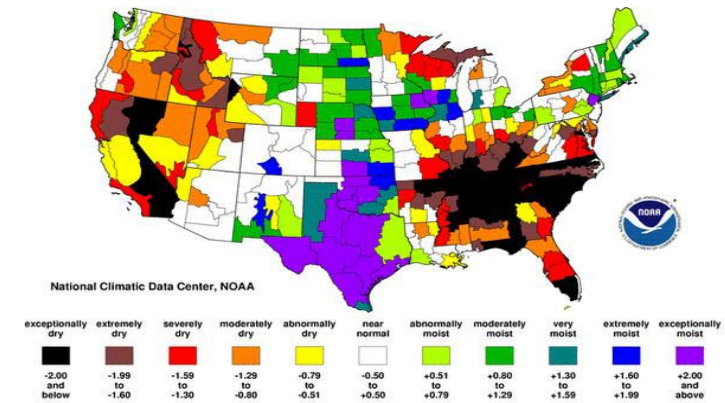
Standardized Precipitation Index
Three Months

June-August 2007

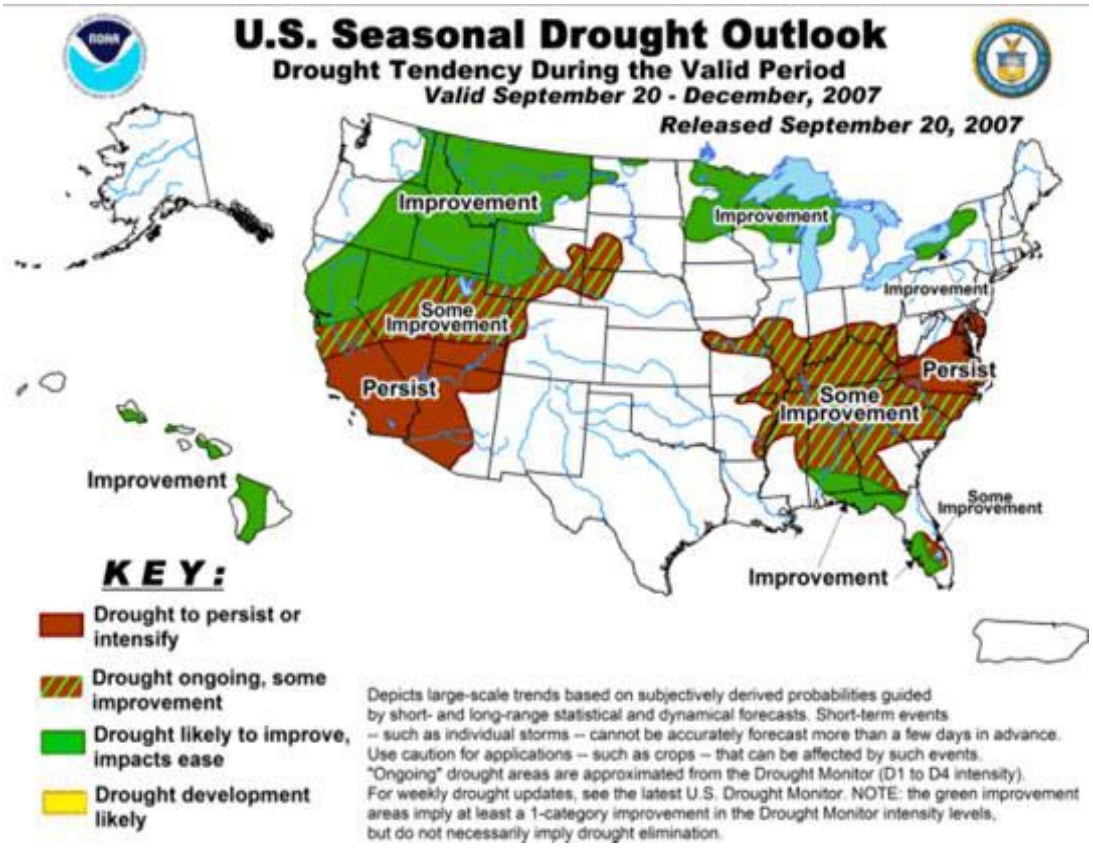


Standardized Precipitation Index
Six Months

March-August 2007



U.S. Seasonal Drought Outlook



The Climate Predication Center issues the U.S. Seasonal Drought Outlook each month in conjunction with the release of the long-lead temperature and precipitation outlooks.

Weather and Climate

PRECIPITATION

The Division of Water monitors a network of 24 daily climate-reporting stations to track developing shortages of precipitation. For the year, precipitation deficits for

Kentucky range from 62 percent of normal in the Eastern climatic division to 76 percent of normal in the Central climatic division.

New Updated Sept. 26, 2007 New

(Click on images to enlarge)

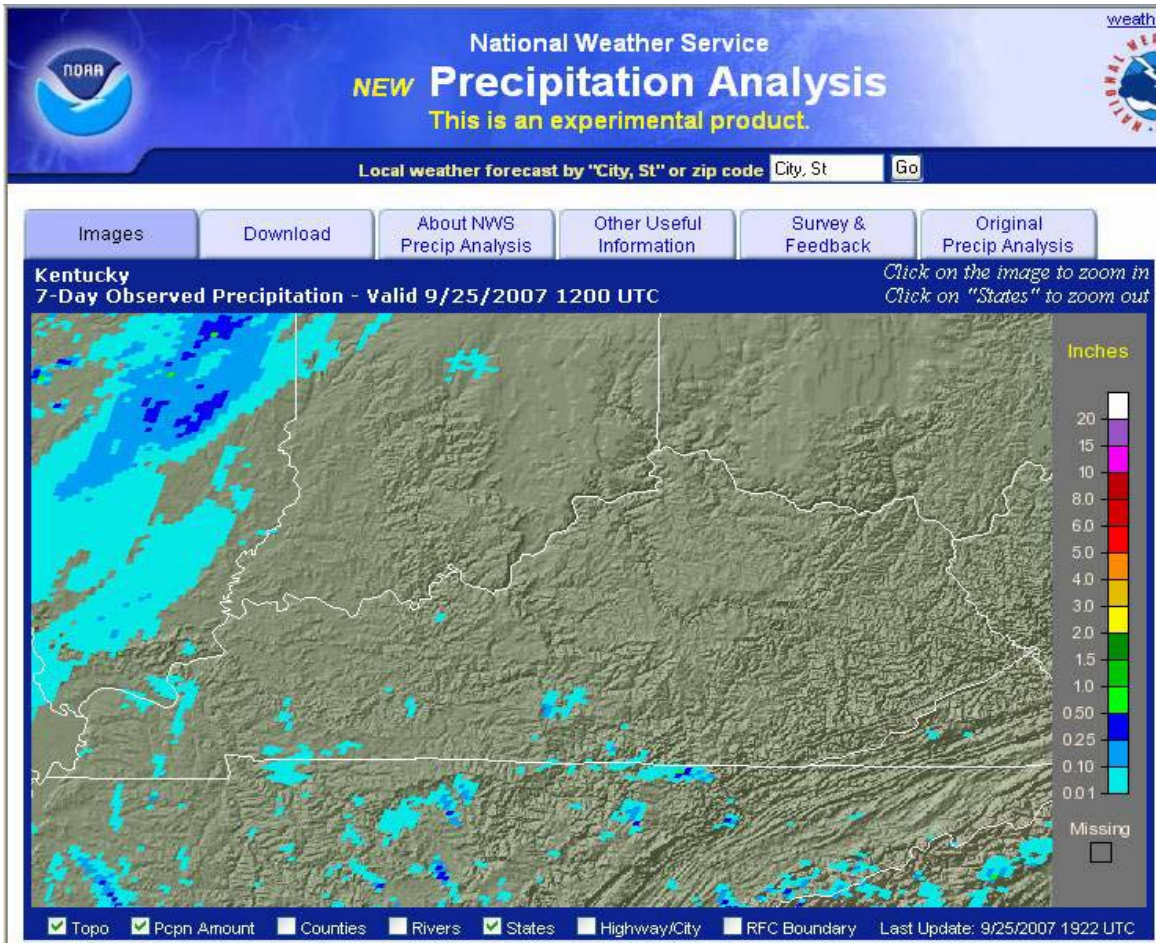
Precipitation: Data for the previous 30/60/90-day period and the Water Year Beginning October 01, 2006

	Water Year		30/60/90 Day Total Precipitation and Departure From Normal					
Station	Precipitation Totals (inches)	Departure From Normal (inches)	30 Day Total (inches)	30 Day Departure (inches)	60 Day Total (inches)	60 Day Departure (inches)	90 Day Total (inches)	90 Day Departure (inches)
Henderson	32.27	1.35	1.29	-3.28	5.88	-2.85	9.26	-4.06
Paducah	33.68	-1.04	2.32	-2.63	5.75	-4.04	8.72	-5.87
Princeton	30.11	-6.18	2.05	-2.88	5.96	-3.64	8.32	-6.07
Mayfield	27.58	-10.52	0.60	-4.16	3.85	-5.93	5.75	-9.21
Louisville	30.34	0.04	1.19	-3.26	6.33	-2.39	9.31	-3.87
Bardstown	27.05	-2.41	0.61	-3.84	5.24	-3.16	8.62	-3.98
Hardinsburg	29.47	-4.05	1.24	-3.48	5.51	-3.58	7.82	-5.70
Campbellsville	29.07	-6.24	1.69	-3.51	7.53	-2.45	11.86	-2.88
Nolin Lake	30.33	-5.12	3.35	-1.90	8.12	-1.79	10.49	-3.60
Glasgow	27.72	-8.33	1.38	-3.63	6.30	-3.32	9.49	-4.98
Bowling Green	25.25	-10.23	2.58	-2.26	6.60	-2.63	7.55	-6.52
Covington	24.60	-3.06	0.92	-3.31	3.46	-4.58	6.07	-6.02
Williamstown	32.10	2.93	1.80	-2.53	5.99	-2.51	12.43	-0.56
Spindletop	21.72	-7.66	1.30	-3.07	4.69	-3.63	7.17	-5.35
Lexington	26.89	-2.48	2.22	-2.14	5.96	-2.35	8.75	-3.76
Dix Dam	24.47	-6.36	1.26	-3.38	5.62	-3.30	9.45	-3.70
Berea	24.11	-6.60	1.49	-3.28	5.69	-3.41	9.30	-3.93
Grayson	24.78	-2.65	1.82	-2.06	5.34	-2.71	8.35	-3.19
Jackson	21.76	-9.63	1.88	-2.52	4.27	-4.27	5.67	-7.06
Quicksand	20.38	-11.12	1.87	-2.65	4.21	-4.45	5.60	-7.24
Buckhorn Lake	18.13	-12.27	0.63	-3.51	3.84	-4.09	6.00	-6.04
London	21.97	-9.18	0.96	-3.29	5.88	-2.32	6.66	-5.77
Somerset	26.75	-7.78	1.30	-3.80	5.31	-4.23	7.63	-6.30
Cumberland Gap	20.80	-14.40	0.30	-4.44	4.62	-4.30	7.75	-5.93

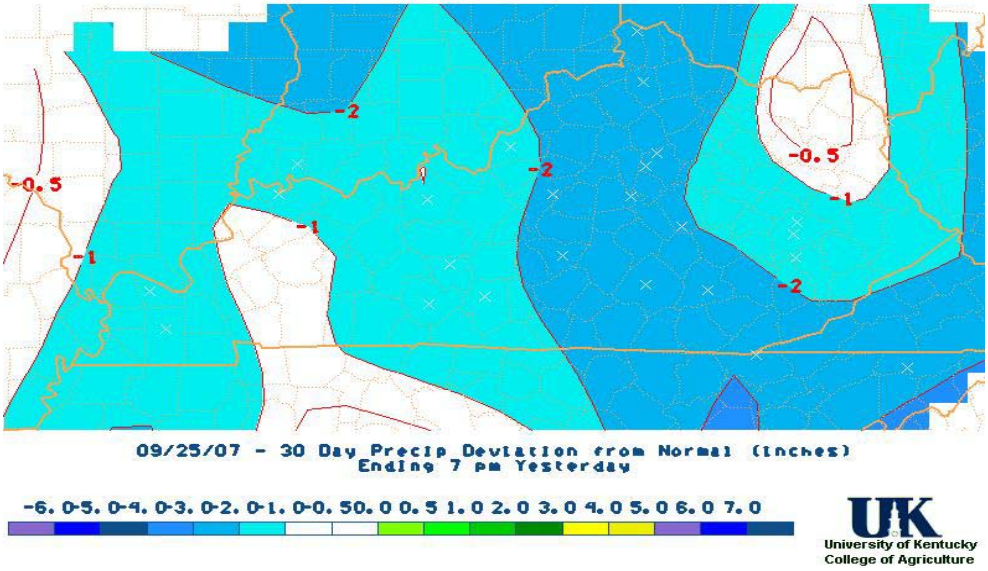
Climatic Division	Normal Precip. Water Year	Normal Precip. Calendar Year	Percent of Normal Precipitation				
			Water Year	Calendar Year	30 Day	60 Day	90 Day
Western (1)	48.89	36.63	81	68	65	40	62
Central (2)	48.79	37.14	82	76	54	66	77
Bluegrass (3)	43.78	33.67	79	73	30	58	72
Eastern (4)	46.51	35.50	67	62	50	61	66

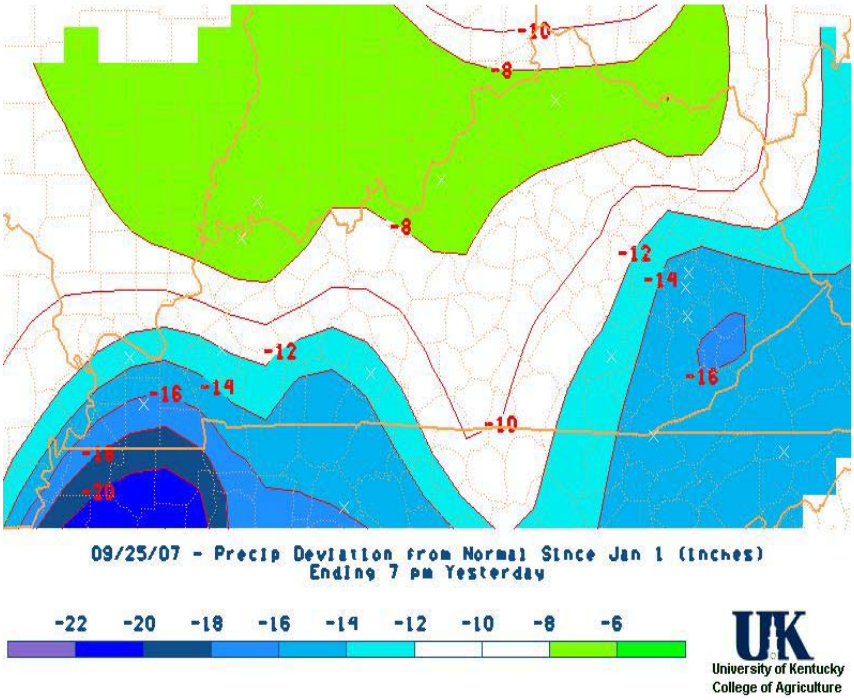
For the seven-day period ending Sept. 25, 2007, no precipitation was reported in the state. Precipitation for the past 30 days in the Eastern, Central and Western climatic divisions averaged 56 percent of normal (50, 54 and 65 percent of normal, respectively) while the Bluegrass climatic division received an average of only 30 percent of normal. During this period, average precipitation amounts of 1 to 3 inches were measured across most of Kentucky. The northern most counties of the Bluegrass climatic division received the least rainfall with totals less than 0.5 inches.

Statewide, the combined precipitation for the months of January through August of this year ranked as the fourth driest for the period since at least 1895 -- the first year of the instrumental record. When the record is truncated to February through August, average annual precipitation for the state ranks as the second driest of the record.

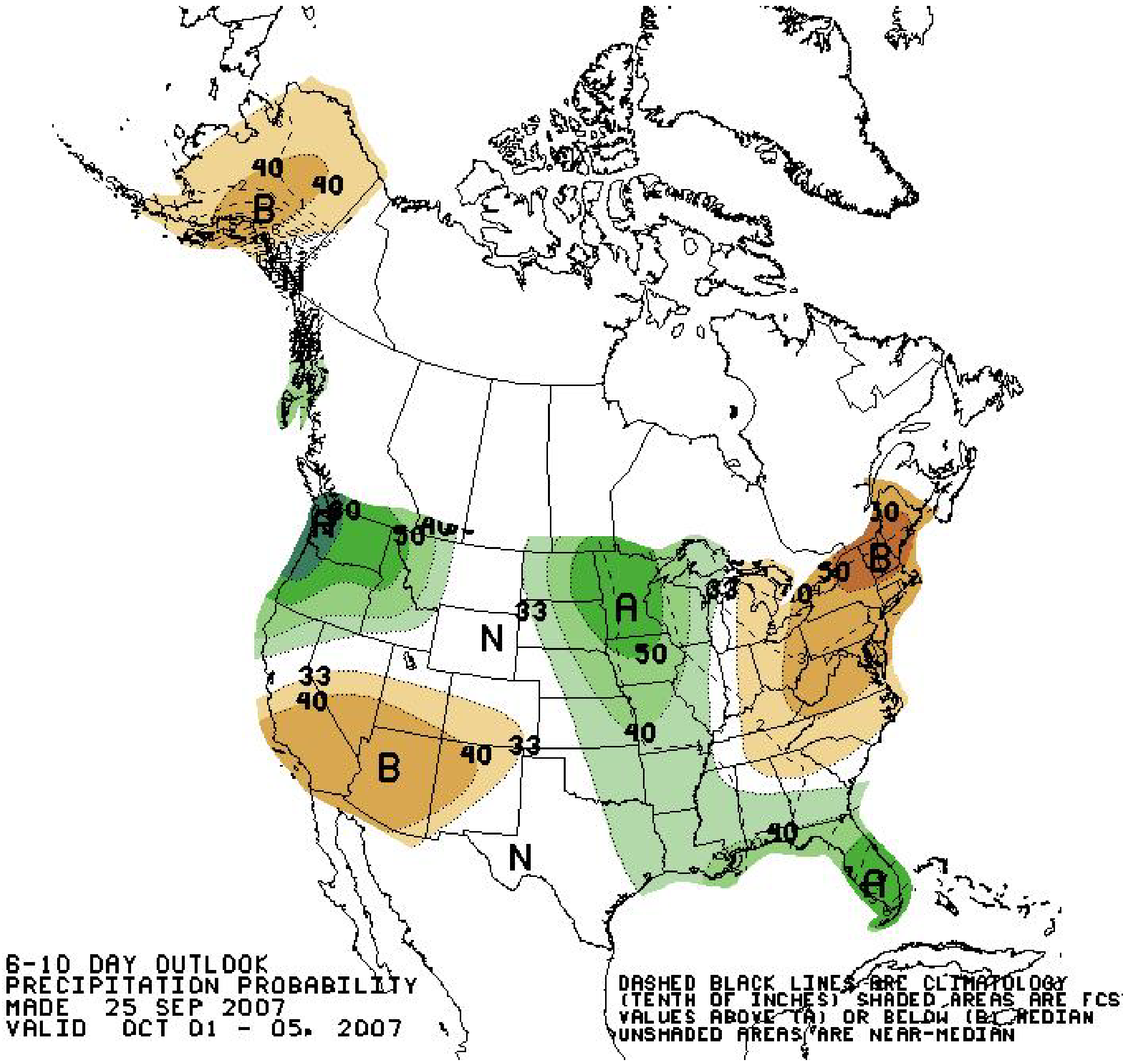


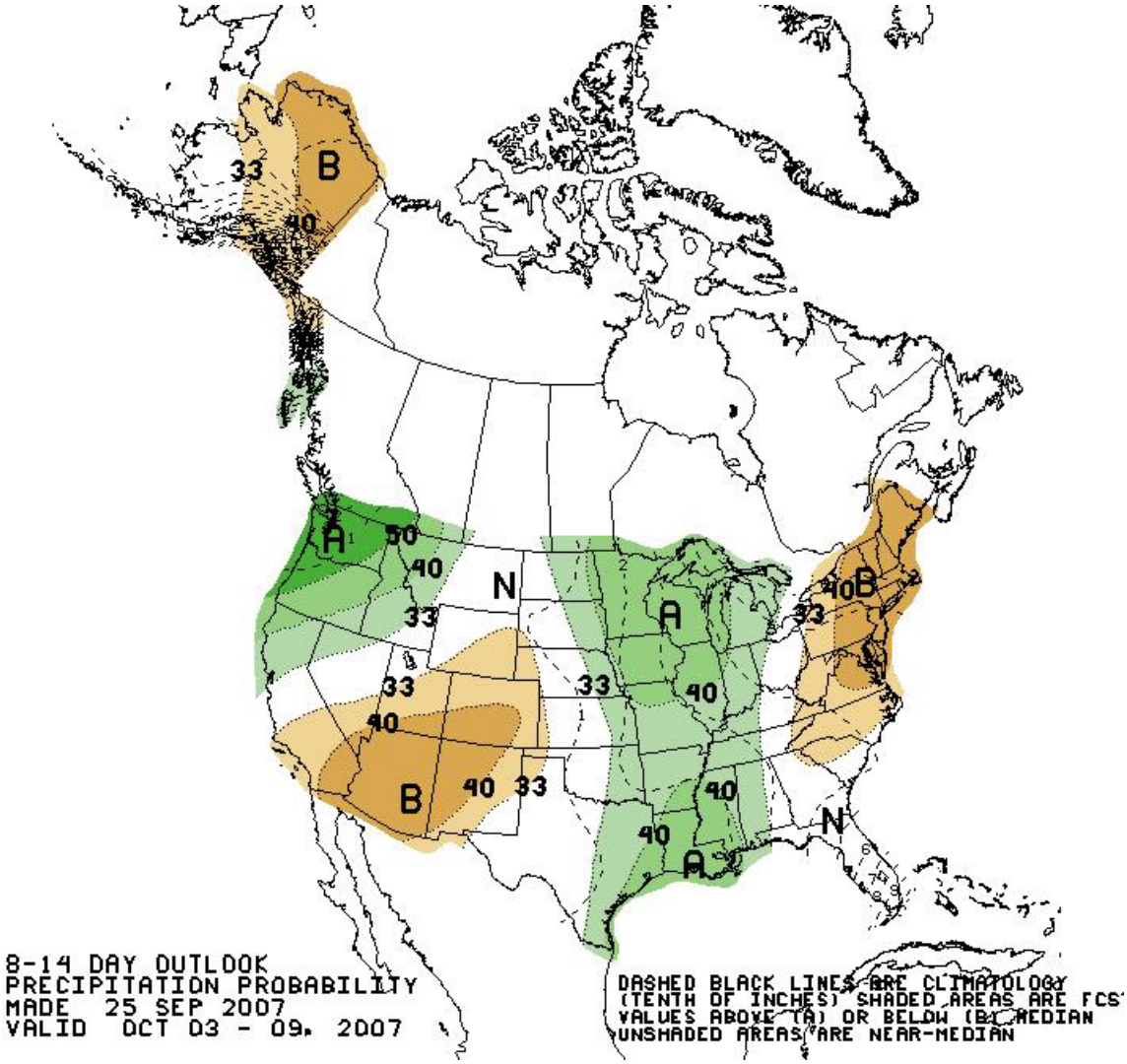
ATTENTION: One of the best tools to assess the amount and distribution of precipitation in Kentucky is the National Weather Service's Precipitation Analysis Product. Data can be displayed for many different time frames and can be selected to show not only the amounts, but also the deficits and percentages of normal for each time frame.





For the year, the largest deficits remain in the southern portions of the Western and Eastern climatic divisions. Ten to 20-inch precipitation deficits have built in parts of the Purchase area of the west. Deficits in the headwaters of the Kentucky, Licking, Cumberland and Big Sandy river basins in the east have reached 12 to 17 inches for the year. Deficits range from 4 to 16 inches in the Bluegrass and parts of south-central Kentucky.


6-10 DAY OUTLOOK
PRECIPITATION PROBABILITY
MADE 25 SEP 2007
VALID OCT 01 - 05, 2007
DASHED BLACK LINES ARE CLIMATOLOGY
(TENTH OF INCHES) SHADED AREAS ARE FCST
VALUES ABOVE (A) OR BELOW (B) MEDIAN
UNSHADED AREAS ARE NEAR-MEDIAN

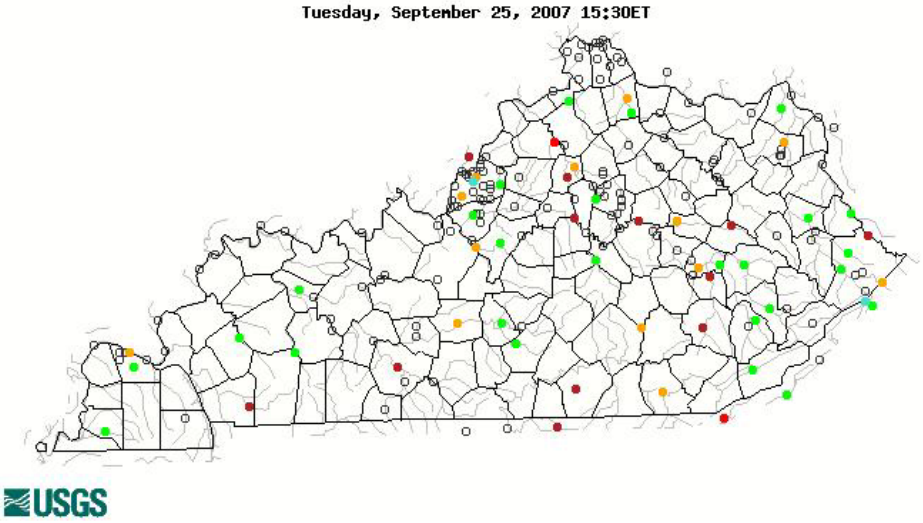


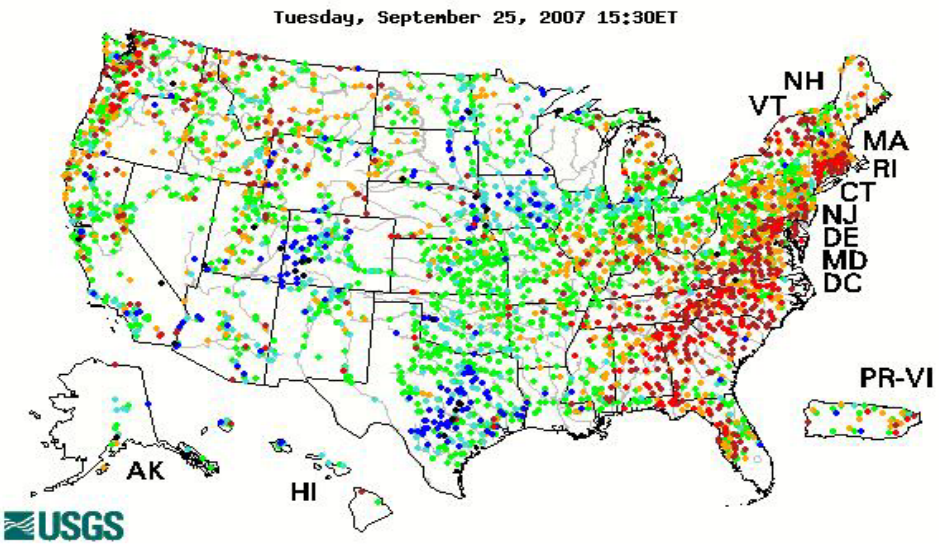
Short-term outlooks from the Climate Prediction Center indicate from below-normal to above-normal chances for precipitation during the next two weeks. The six- to 10-day outlook calls for below-normal across the state. When expanded to 14 days the outlook is above-normal in the west and equal chances for below-normal, normal and above-normal rainfall in the east. One to three month outlooks from the Climate Prediction Center mostly indicate equal chances for below-normal, normal and above-normal rainfall for the state. The one month outlook does include the north-eastern region of the state in an area designated as above-normal.

Hydrology

STREAMFLOWS

The U.S. Geological Survey maintains a real-time stream gauging network that monitors flows in all major river basins in Kentucky. Measurements of streamflow are a very good indicator of the longer-term hydrologic impacts of drought. During the developing stages of drought, streamflows provide valuable information on the severity and regional extent of emerging problems. Streamflow data is evaluated relative to the long-term record to determine drought intensity and identify potential problems associated with water shortages. Once a drought has matured, streamflow measurements are critical at many locations where water withdrawals have the potential to cause adverse environmental impacts to streams.





New Updated Sept. 26, 2007 New

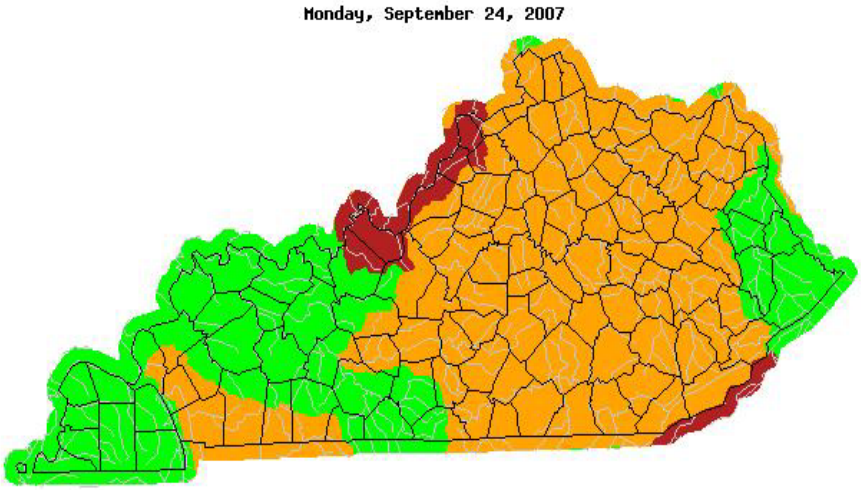
With the general lack of precipitation and high temperatures, streamflows across the state continue to decline. Approximately half of the real-time stream gauging network is currently below a normal range for this time of year (less than a 25 percentile flow). Nearly one quarter of the gauges are now classified as much below-normal (less than a 10 percentile flow).

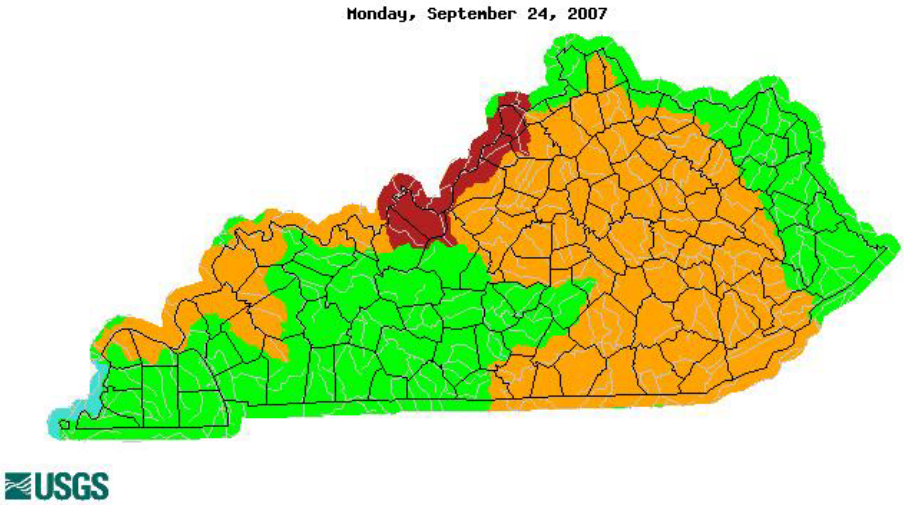
Weekly and Monthly Streamflow

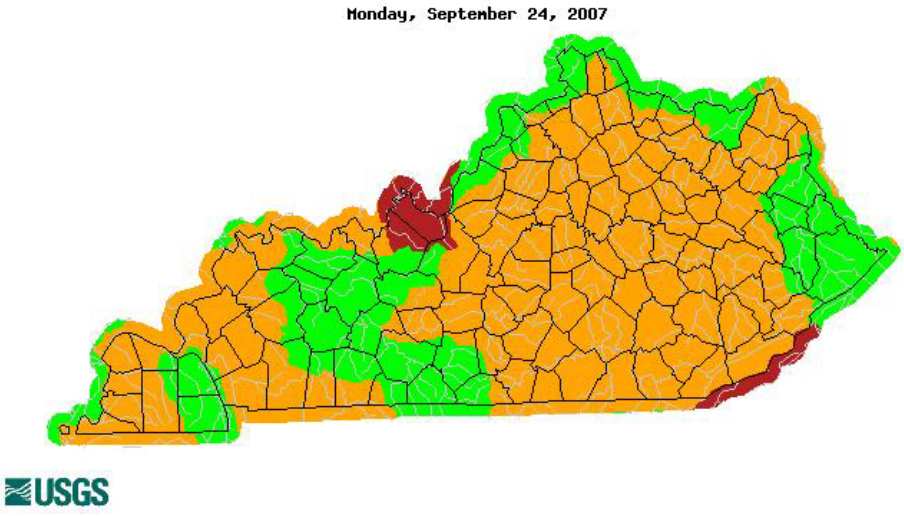
For a slightly longer-term perspective of streamflow conditions across Kentucky, the United States Geological Survey computes average flows for the previous seven, 14 and 28 days. The resulting average streamflow values are categorized relative to the long-term record and assigned levels of severity based on the frequency that similar magnitudes of low-flow have occurred in the past. By averaging over a period of several days to several weeks, the values on the map are more indicative of longer-term conditions than daily average or real-time streamflow measurements.

New Updated Sept. 26, 2007 New

Seven-Day Average Streamflow **14-Day Average Streamflow** **28-Day Average Streamflow**







The 28-day average streamflow indicates that flows remain significantly below-normal in the western portion of the Salt River basin. Elsewhere, long-term flows

are below-normal in the Licking, Tradewater, Kentucky, eastern Green, eastern Salt, Lower and Upper Cumberland and Little Sandy river basins and the western Purchase region. Flows in the Big Sandy, western and southern Green river basin, the eastern Purchase and along the Ohio River in the north are within a normal range.

Lakes and Reservoirs
U.S. Army Corps of Engineers Projects

Another useful measure of the impact that drought is having on a region is the status of area lakes and reservoirs. The Division of Water monitors data from 12 projects operated by the U.S. Army Corps of Engineers (USACE) from three USACE districts: Louisville, Huntington and Nashville. These projects strive to maintain reservoirs at pool levels consistent with the operating guidelines as part of the larger mission of flood control and navigation in the Ohio and Mississippi rivers. Beginning in April, the releases from the reservoirs are managed to allow filling to the "normal summer pool elevation." Significant precipitation deficits in the basin above the reservoir can adversely affect the attainment of normal summer pool elevation. This, in turn, may result in low flows in the river below the project when releases from the reservoir are reduced to the minimum needed for water quality and aquatic habitat.

By examining the data for "current pool elevation" and "current outflow," valuable information about the status of large headwater areas above the USACE reservoirs can be obtained.

United States Army Corps of Engineer Reservoir Information
Updated Sept. 26, 2007

September 25, 2006

Basin	Project	Current Outflow (cfs)	Normal Summer Pool Elevation (ft)	Current Pool Elevation (ft)
Little Sandy	Grayson	25.5	645	642.1
	Dewey	23.9	650	649.6
	Fishtrap	81.3	757	753.4
	Yatesville	24.9	630	628.9
Big Sandy	Paintsville	10.5	709	708.4
Licking	Cave Run	50.0	730	729.0
	Carr Creek	33.0	1027	1025.8
Kentucky	Buckhorn	40.0	782	780.0
Salt	Taylorsville	32.0	547	543.8
	Green River	49.0	675	673.8
	Nolin	232.0	515	514.6
	Barren River	87.0	552	547.7
Green	Rough River	1970.0	495	481.6

As of Sept. 25, 2007, reservoir levels are below the normal summer pool elevation at Taylorsville Lake in Spencer County, Green River in Taylor County, Barren River Lake in Barren County, Grayson Lake in Carter County, Cave Run Lake in Rowan and Bath counties, Carr Creek Lake in Knott County, Buckhorn Lake in Perry and Leslie counties, Yatesville Lake in Lawrence County, Paintsville Lake in Johnson County and Fishtrap Lake in Pike County. It is noteworthy that both Barren River and Rough River lakes have been at or near the minimum release since mid-March, further evidence that the current drought conditions have been under development for some time. Rough River Lake is now being dropped to winter pool elevation to allow for repairs.

Small Lakes and Water Supply Reservoirs

The Division of Water will monitor selected small water supply reservoirs when conditions indicate that water supplies may be threatened by persistent drought. Several small water-supply lakes are now approaching abnormally low levels and they will continue to decline with the precipitation deficit. Customer demand has forced a number of these water systems to call for conservation measures.